Subterranean Inhabitants of the Lower Potomac Drainage

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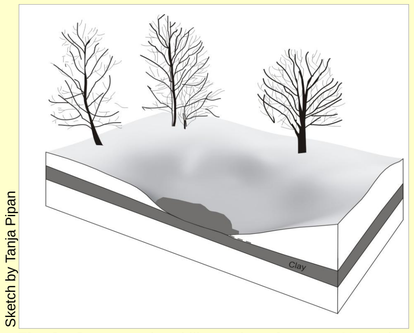
The Habitat

In the national parks of the lower Potomac drainage, a careful observer may notice small wet spots with no apparent source. These wetspots are fed by precipitation, which is retained only a meter or so underground by a clay layer that slows drainage (Fig. 1-2). Sometimes called seeps, the Croatian biologist Milan Meštrov provided a scientific description of this habitat in 1962, calling it the hypotelminorheic zone. Several characteristics distinguish seeps from superficially similar habitats such as vernal pools, puddles, and springs (Table 1). It is becoming apparent that this inconspicuous and fragile habitat harbors some of the lower Potomac's rarest, most peculiar species (Pavek, 2002).

Photo by William K. Jones

Fig 1: Typical seep of the lower Potomac drainage.



Sketch by Tanja Pipan

Fig. 2: Cross-sectional illustration of seeps. Note clay layer which slows downward movement of water.

Table 1: Physical and chemical characteristics of the hypotelminorheic zone (Culver *et. al.* 2006).

1.	A persistent (or semi-persistent) wet spot.
2.	Fed by subsurface water in a slight depression in an area of low to moderate slope.
3.	Rich in organic matter.
4.	Underlain by a clay layer typically 5 to 50cm beneath the surface.
5.	Drainage area typically less than 10,000 m^2.
6.	Dark color derived from decaying leaves which are usually not skeletonized.
7.	Richer in dissolved oxygen than other small water bodies.

Adaptation

Many of the species unique to seeps have traits associated with a subterranean existence. Most noticeably, they are eyeless and without pigment. A study of the amphipod genus *Stygobromus* Fig. 4) revealed that the hypotelminorheic species *S. tenuis potomacus* has a metabolic rate higher than the that of the deep cave dweller *S. emarginatus* and closer to that of the species *S. spinatus,* found in the upper reaches of caves (Fig. 3). Reduced metabolic rate is often found in organisms living in food-poor environments. More food is available in seeps than in caves.

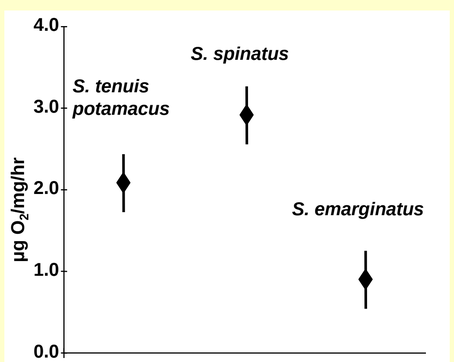


Fig. 3: Metabolic rate for 3 species of *Stygobromus* (Culver and Poulson, 1971).

The Species

Photo by William K. Jones

Fig. 4: *Stygobromus tenuis potomacus.*

Five species of the amphipod genus *Stygobromus* (Fig. 4) dominate the specialized seep fauna of the lower Potomac, including one of only three federally endangered species listed for Washington, DC. The most common of these is *Stygobromus tenuis potomacus*. *S. pizzinii* can be locally abundant but is not as broadly distributed. The federally endangered *S. hayi* is known from only a handful of seeps in the National Zoological Park and Rock Creek Park. Rarer still, *S. kenki* is known from only 4 sites in Rock Creek Park. An undescribed species of *Stygobromus* has also been found in a few, isolated seeps in the George Washington Memorial Parkway, Rock Creek Park, and Prince William Forest Park.

In addition to amphipods, isopods of the genus *Caecidotea* (Fig. 5) are common in seeps. The most common isopod in seeps of the lower Potomac drainage is *C. kenki,* which is mostly restricted to seeps. *Caecidotea* is a large, aquatic genus, that can be found in a wide range of surface and subterranean aquatic habitats across North America.

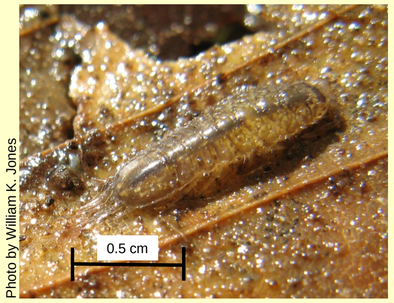


Photo by William K. Jones

Fig 5: *Caecidotea kenki.*

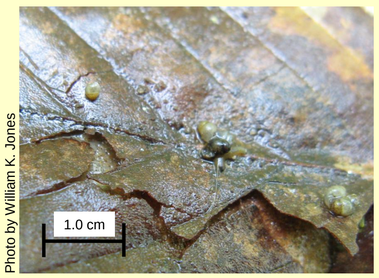


Photo by William K. Jones

Fig 6: *Fontigens bottimeri.*

A single described species of snail, *Fontigens bottimeri* (Fig. 6), is restricted to seeps in the Potomac drainage. Snails of the genus *Fontigens* are commonly known as spring snails. These small snails inhabit caves, springs, and seeps in the eastern US.

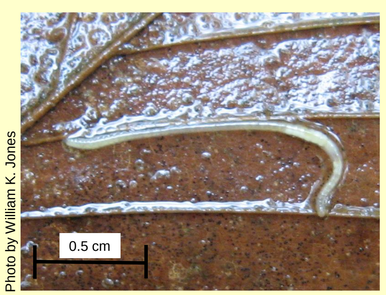


Photo by William K. Jones

Fig 8: Unidentified aquatic annelid worm.

Seeps may have a distinctive flora that can indicate the presence of shallow groundwater (Fig. 7) during dry periods.

Photo by William K. Jones

Fig 7: Skunk cabbage, *Symplocarpus foetidus,* can often be an indicator of seeps in the lower Potomac drainage.

The seep fauna has not been studied in great detail, and the potential for discovery of new species is great. Furthermore, because convergent morphology is common in subterranean habitats, some currently recognized species may actually be multiple species. The worm in figure 8 is an unidentified, and probably undescribed species which may be restricted to seeps. Taxa such as annelids, copepods, and mites are understudied, but may represent a significant portion of the specialized seep fauna.

Where Seeps Occur

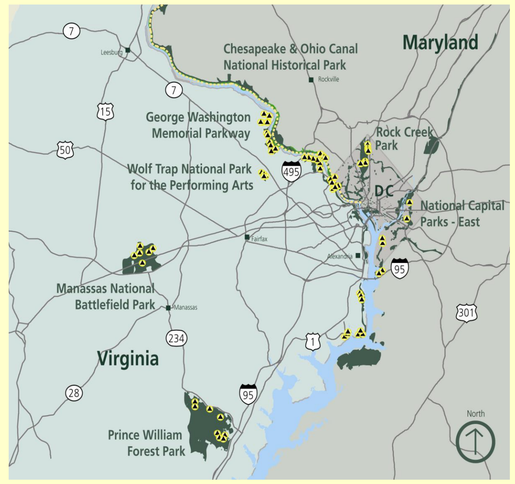


Fig 9: Seeps of the lower Potomac drainage that have been sampled for fauna and physical and chemical parameters since 2003. Map by Tammy Stidham.

Since 2003, 126 seeps have been identified and sampled throughout the lower Potomac Drainage (Fig. 9). Of these, 62 (49%) harbored one or more specialized seep species, and 49 (39%) harbored one or more species of *Stygobromus.* The following parks have been sampled: Chesapeake and Ohio Canal National Historic Park, George Washington Memorial Parkway, Riverbend Park, Scott's Run Park, Rock Creek Park, National Capital Parks East, Prince William Forest Park, Wolf Trap National Park for the Performing Arts, and Manassas National Battlefield Park.

Management

Many of these seeps are at risk from various anthropogenic threats due to urbanization or agriculture. Table 2 lists some of the threats to seep habitats. Sampling for seep fauna can be difficult. The Bou-Rouch pump (Fig. 10) is designed to be hammered into shallow subterranean aquatic habitats to pump out groundwater animals.

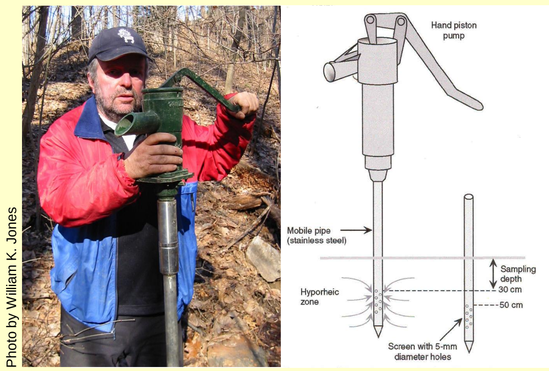


Photo by William K. Jones

Fig 10: The Bou-Rouch pump.

Table 2: Management concerns for seeps.

1.	Point-source inputs of contamination from spills (oil, gas, etc.).
2.	Nonpoint-source inputs of from run-off and storm water (heavy-metals, salt, etc.).
3.	Reduction of aquifer recharge due to impervious surface or rainwater redirection.
4.	Isolation of seeps from one another by impervious surface or rainwater redirection.
5.	Soil compaction from farming equipment, foot traffic, etc.

References

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